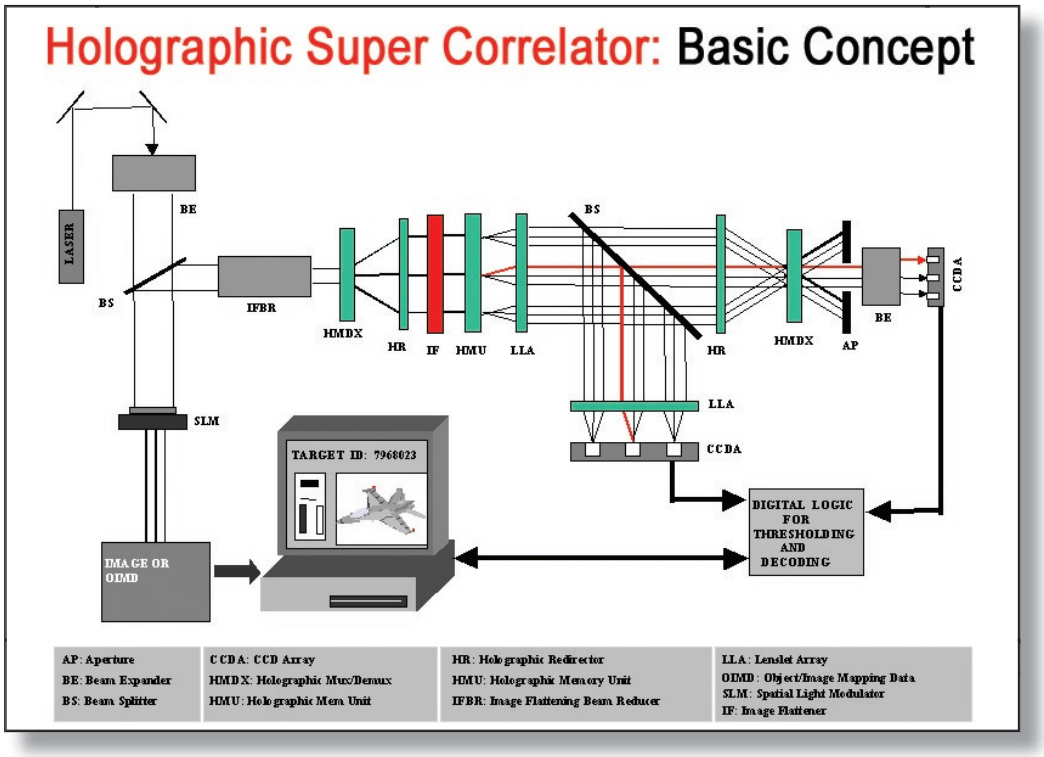
Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

IMPROVING DIGITAL SIGNAL PROCESSING THROUGH HOLOGRAPHIC RECORDING AND STORAGE



Identifying enemy aircraft and missile threats may become easier thanks to the efforts of two Air Force Office of Scientific Research (AFOSR)-funded scientists. Working on related but separate projects, Professors Dmitri Psaltis and Selim Shahriar discovered different methods of improving digital signal processing (DSP) through holography.

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Accomplishment

Professor Psaltis teamed with fellow California Institute of Technology electrical engineering professors, Zhiwen Liu and Gregory Steckman, to develop a holographic system to record fast events. The resulting performance is comparable to the current state of the art for a multi-camera system. Professor Shahriar and fellow researchers at Northwestern University joined scientists at the Massachusetts Institute of Technology and Digital Optical Technologies in Somerville, Massachusetts, to improve DSP speeds by using a simple holographic optical corrrelator.

Background

Holography allows users to search in a parallel fashion. If users are trying to track and identify an enemy plane, the plane could appear at different distances and in different orientations, requiring as many as 10,000 pictures in the database for all possible orientations of just one plane. In simplest terms, Professor Shahriar's approach deals with massive storage for image processing applications such as satellite pictures. Professor Psaltis' approach looks at recording extremely fast events, which causes an issue of storage capacity versus speed.

Professor Psaltis and his colleagues developed a holographic method for recording fast events on nanosecond timescales. They extended their technique by using shorter pulses and generating the signal beam pulse train through wavefront division or nonlinear optics.

While Professor Psaltis' and Shahriar's holographic methods have obvious military applications, their research might also benefit biologically based identification processes such as fingerprinting or comparison of dental images. The AFOSR's Physics and Electronics Directorate currently supports Professors Psaltis' and Shahriar's research.

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Additional information

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